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AUTHOR	Tiedeman, David V.
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ABSTRACT

The information system of the Educational Resource Information Center (ERIC) program and that of information System for Vocational Decisions (ISVD) are compared. The ERIC system, with its focus on data reduction and interactive retrieval, is seen as lacking certain crucial components which would make of it an information generating system, one which because of its design will involve users in a personal decision-making/change process. Elements being deliberately built into the ISVD system include: (1) data reduction by the inquirer himself and his subsequent retrieval of this data; and (2) explicit attention to personal decision making during both of these stages. The total system is intended to turn facts/data about educational, military and vocational opportunities into the information of a personally determined career. The system's datafiles are described, as is the author's conception of how the system and its users interactions will utilized them toward the goal of the users' purposefully and personally choosing their own careers. (TL)

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THE ROLE OF DECISION-MAKING IN INFORMATION GENERATION: AN EMERGING NEW POTENTIAL IN GUIDANCE

David V. Tiedeman

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Graduate School of Education
Harvard University

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The Role of Decision-Making in Information Generation: An Emerging New Potential in Guidance[1]

David V. Tiedeman
Graduate School of Education
Harvard University

Data Storage and Retrieval: Rudiments of Information

Needed for Guidance: Information Generation, Not Just Fact Retrieval. Walz and Rich recently succinctly described the information process inherent in the Educational Research Information Center (ERIC) program of the United States Office of Education.[2] In this so-called information process, research reports are assembled, abstracted, and indexed. Reference and/or recovery of an article then becomes possible either directly or through index and/or abstract. The direct recovery of an article either bypasses or completes the recovery process. If the recovery process is bypassed, the person inquiring in the ERIC system has either been lucky or he pretty much knew what he wanted when he addressed the system. When article recovery actually completes a process which has included prior reference to abstract and/or index, the person is ordinarily then motivated to read the article because he has already engaged in a prior search for it. In the latter event, however, motivation is a peripheral, not primary, effect of the ERIC program.

The primary reason for ERIC then is to get an article into the hands of interested inquirers, not necessarily to interest the inquirer in inquiry

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1. Prepared for CAPS Capsule, Counseling and Personnel Services Information Center, The University of Michigan, February 1968.
2. Walz, Garry R.; and Rich, Juliet V. "The Impact of Information Systems in Counselor Preparation and Practice," Counselor Education and Supervision, 1967, 6, 275-284.

itself which is the purpose of guidance. Therefore, I want to address that peripheral interest developing reason for existence of an information system, namely the capacity to lead an interested but originally uninformed inquirer to articles which are relevant to a reason for the inquiry generated by the inquiry process itself. In bringing your attention upon this distinction, I hope thereby to interest you in the educational capacity latent in data storage and retrieval, not just its recovery capacity. However, before doing so, I want first to remind you of the actual structures of data assembly, abstraction, and indexing themselves as well as of some of the interest generating potential latent in those processes.

Abstracting and Indexing. Walz and Rich indicate that two preparatory phases are required to aid identification of relevant articles for an interested but somewhat uninformed inquirer. The first phase is that of abstracting the original article. Abstraction moves the meaning of an article from the realm of detail to that of generality. A good abstract is one which reduces the original while still remaining reasonably consistent with it. Since abstract and original are never identical, there is always a loss of detail in an abstract. However, the abstracter engages in considerable effort to insure that the reduction of meaning because of abstraction is small.

The second phase in making relevant articles useful for an interested but somewhat uninformed inquirer is that of indexing. The first task of indexing is to assign the article to each of one or more primary categories of the several pre-determined categories. Natural language processing of the words of an abstract now permit such indexing to be done by computer. The second task of indexing is the cross-indexing of articles to a secondary set

of the pre-determined categories. This secondary task of recognizing and responding to synonyms of primary terms is accomplished by means of a thesaurus. Assignment of articles to synonymous categories is now also accomplished by computer once a thesaurus is placed in the memory of the computer.

After the abstract of an article has been indexed, recovery of the article becomes possible by direct selection of indexed terms. However, direct selection ordinarily leads to a large quantity of citations in a system of the magnitude of ERIC. The number of recovered citations can be reduced and the relevance of the reduced number of citations increased by using what Walz and Rich refer to as "coordinate index terms." "Coordinate index terms" are two or more of the indexed terms and/or their synonyms. When the inquirer uses "coordinate index terms" he succeeds in identifying citations occupying the union of the two or more index terms which he has selected. The use of "coordinate index terms" in an interactive computer system starts with the construction of a sentence which describes the desired citations. The sentence as decomposed and re-sequenced by computer programs then in turn operates the computer and leads to a list of the citations fulfilling the conditions of the union of "coordinate index terms" actually specified by the original sentence. Programming of computers now makes this approximation of sentence-like demands for data possible, practical, and even reasonably satisfying.

Potential for Information Generation Inherent in ERIC. Walz and Rich carry their argument from the above delineation of information retrieval to consideration both of predictable outcomes and of implications for pupil

personnel services. These predictions and their implications consitute a potential possible in ERIC but not now thoroughly implanted as I shall then go on to show.

Predictable outcomes of the process of data decomposition and article retrieval are, according to Walz and Rich: 1) synthesis and evaluation become dominant processes; 2) gaps in the information structure become evident; 3) use of impersonal resources increases; 4) opportunity for inter-professional interaction increases; 5) information, not a book, is retrieved; and 6) time to information is reduced and the band width of information is increased. The implications of data decomposition and article retrieval for pupil personnel services are: 1) the approach to learning will become that of inquiry; 2, 3, 4) the information generation process will require new learning approach skills including stress upon the processes of evaluative integration and of information coagulation, not absorption; 5, 6) changed methods of professional communication and increased collaborative efforts will occur; and 7) small esoteric information systems will develop.

Walz and Rich have enumerated important sets of outcomes and implications. However, their conclusion is:

> Perhaps one of the most important conclusions to be drawn from reviewing the outcomes and implications of information systems is that they may well <u>not</u> <u>be</u> a significant force for change. Wherever we have used "will", we just as well could have inserted "can". We are more assured that the mechanics of information systems are workable than we are that individuals can make the necessary changes in attitudes and beliefs to use them. The emergence of information systems is undeniably a force for change in counselor education. Whether it results in changes or not will depend upon the professional response to that force.

<u>Goal: Information Generation</u>. Walz' and Rich's conclusion is an

exact one for the ERIC system itself of which they write. However, it is not a necessary conclusion for all computer-controlled interactive systems. Inherent in the ERIC project are only rudimentary conditions of information generation, namely data reduction and interactive retrieval. Missing, however, are the elements of data reduction by the inquirer himself and his subsequent retrieval of reduced data while explicit attention to decision-making is being created during both his reduction and retrieval processes. These missing elements will be a deliberate part of the Information System for Vocational Decisions (ISVD) which several colleagues and I[3] have under construction. The missing elements to be furnished by the ISVD will actually turn data retrieval into information generation, the process I want to highlight for you. However, I must first describe the ISVD itself before I can continue to highlight information generation.

The Information System for Vocational Decisions

Primary Data Files. The Information System for Vocational Decisions is to be a system in which facts/data[4] about educational, military, and vocational opportunities are to be turned into the information of a personally-determined career. The ISVD will therefore consist of three primary data

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3. Principal Investigators of ISVD are Russell Davis, Richard Durstine, Allan Ellis, Wallace Fletcher, Edward Landy, Robert O'Hara (Executive Director), David Tiedeman (Chairman), and Michael Wilson. Research Associates of ISVD include: Duncan Circle (1967-68); David Clemens (1966-67); Lawrence Lerer (1966-69); and Eugene Wilson (1966-69).

4. Facts/data come in two conditions, fixed and modifiable. I therefore elect to adopt the cumbersome term, "facts/data", to indicate this fact throughout the paper. Facts are directly recoverable without mediation except for storage and later recovery. On the other hand, data must be additionally processed by the numeric and/or linguistic routines of a mediational system.

files, one for each of those opportunities. The ISVD data files will be much like the files of abstracts created for the ERIC system. However, each of these three primary data files in the ISVD will itself be partitioned in several ways. One of these partitions in each file will be for its use in exploration or clarification. The facts/data of an educational, military, and occupational alternative will be fewer and at a more general level for the exploratory mode than for the clarificatory mode. When exploring an inquirer will not be expected to maintain preference for an alternative; he will be expected to be forming his bases for preferences among a personally-favored set of alternatives. When clarifying, the inquirer will be expected either to maintain his preference for an alternative or to return to exploration. In this phase of decision-making, the inquirer is expected to bring the perspective of doubt to a previously crystallized basis of choice and to bear the anxiety of ignorance in the face of new facts about the chosen alternative.

The second partition of each of the primary data files will be applied <u>within</u> each of the exploratory and clarificatory parts of a data file. The second partition will be by the discontinuity in life for which the data file is conceived to be pertinent. In the case of the education data file, steps will be toward subject specialization as represented in the choices of: 1) high school curriculum; 2) post-secondary institutions; 3) post-secondary specialty; 4) graduate institutions; and 5) graduate specialty. In the case of the military data file, steps will be toward promotional opportunity within choice of enlisted and officer ranks of each of the three Armed Services. In the case of the occupation data file, steps will be toward specialization as represented in the choices: 1) occupation; 2) job or placement; 3) position

and/or promotion; and 4) career.

The occupation data file will have an adjunctive file which will incorporate forecasts for occupations and permit file blocking of occupational facts/data according to national and regional conditions. The primary purpose of this set of forecasting facts/data will be developed later while discussing the planning phases of career decision-making.

Purpose and Self Development The ISVD will offer access to the three primary data files within the context of achieving purposeful activity during self development. Two pedagogical modes will be provided for this context. One pedagogical mode will be teaching about concepts relevant to purpose in self development. The concepts included in this mode will be: 1) the psychology of becoming purposeful; 2) self and decision-making; 3) psychological attributes and educational, military, and occupational decisions; and 4) any needed instructions for use of the three primary data files.

The second pedagogical mode will be that of decision-making applied to the data both of another's life and of one's own life. The basic pedagogic mode with the data of another's life will be that of a game. An inquirer and others will either cooperate or compete in playing rounds with the data of another's life and his decisions which are to be anticipated. This game context essentially requires time planning in relation to future possibilities and consequences. The context of time planning will be in terms of education, work, leisure, and family. Future possibilities and consequences will be retrieved from the forecasting data file mentioned earlier. The playing of rounds of the game will provide rudimentary simulation of career development. However, the ISVD will also let inquirers substitute their own

data in the game structure and will then use this simulated career development structure in personal decision-making. In personal decision-making, the basic pedagogic mode will be that of guidance in counseling.

Subsidiary Data Files and Routines. The substitution of one's self for the life circumstance of another will create need for two kinds of subsidiary files. One subsidiary file will be that of the individual's education and psychological characteristics. This file will be created and maintained both to permit counselors to call for cumulative records and to permit individual inquirers to generate alternative possibilities for themselves at decision points by using the predictive framework in relation to the anonymous psychological characteristics and choices of previous persons whose histories of prior psychological characteristics and later accomplishments are stored in this file. This particular technique will in the ISVD be augmented by a procedure due to Thomas Hutchinson. The Hutchinson procedure will allow the inquirer to specify both alternatives he is considering and levels of reward which he seeks from each specified alternative. The procedure will then provide indication of whether the inquirer's psychological data are like those of others who before him chose the alternative and achieved the designated rewards or not.

The second subsidiary file will store the elements of the person's decisional frameworks in working out his life plans. The file will consist of summary statements which the person generates at the conclusion of each personal decision-making episode and of the cognitive structuring of his career arising from using the routines of REVIEW, EXPLORATION, and CLARIFICATION applied repetitively in relation to each discontinuity with which the person

addresses his future and learns from his past in the ISVD. The inquirer will of course himself be engaged in abstracting his life circumstance while creating these data for his file.

Inherent in the subsidiary file on the person's decisional framework will also be a procedure due to Terence J. O'Mahoney. This procedure will be a paired comparison of vaguely pictured occupational activities presented for reason of exposing the person's self concept in the context of occupational activity. These paired comparison operations applied to pictures will give a person clearer understanding of himself in ideal and actual terms. The understanding will then be an explicit basis upon which the inquirer can deepen his knowledge of his union of personality and occupation. Use of the procedure will be available for the mode of exploration, not clarification. In short, the O'Mahoney procedure will be one of the System's procedures for permitting decision in an educational, military, occupational, and family context for reason of discovering harmonies and disharmonies in personal psychologies and activities. The pictures of the single illustration which O'Mahoney now has available will have to be expanded for such more widespread use, of course.

From Facts/Data to Information:

MONITOR as Information Generating Function

Information from Facts/Data. Walz and Rich indicated in the quotation noted earlier that the existence of data reduction and retrieval can have the consequences of theirs which I enumerated prior to the quotation itself.

However, Walz and Rich stop somewhat short of asserting that data reduction and interactive retrieval acutally will have the noted consequences. I in turn claim that the Information System for Vocational Decisions brings data reduction and interactive retrieval into a condition where the Walz and Rich consequences actually will be realized, not just can be realized. I interrupted my defense of that assertion by the necessity to describe the ISVD itself as an interactive data reduction and retrieval system embedded within decision-making. Decision-making thereby has the role of information generator in the ISVD. Facts/data are turned into information by the inquirer within the context of decision-making when decision-making is subject to MONITOR, a concept I now specify.

ISVD and MONITOR. The basic scheme of ISVD is to have data files in which previously known facts/data are stored. The System will then expect and shape personal interaction with the data files. Personal interaction is both to be taught and to be used in the System. Use of the System can first be as a game and then in the reality of one's own life. Access by way of the routines, REVIEW, EXPLORATION, and CLARIFICATION, provide the context of use in one's own life under guidance of the System. The Access Routines will depend on the primary and coordinate index terms coded into the data files. These index terms will be such as to locate synonyms within and between files and to cross-reference categories from file to file. The thesaurus of synonyms and the coordinate index terms will primarily be developed from vocational development, vocational maturity, and agency development theories.

MONITOR will then be fashioned to operate at three levels. At the

rudimentary level vocational development, vocational maturity, and agency development theories will just be used within the paradigm of decision-making which O'Hara and I have specified.[5] The System will itself be programmed to assess the quality of decision-making as applied to the categories of the data files within the several theories. This will provide a first-order and mechanistic way of guarding against failures of personal operation during the decision-making uses of the ISVD.

The second level of operation of MONITOR will be that of giving the inquirer access to the rules and procedures of the first-level monitor. The inquirer will need to be taught how abstracts and the primary and coordinate index terms as well as the thesaurus of the data reduction process inherent in the REVIEW Access Routine are made. The inquirer will also have to be given access to the actual procedures by which a primary and coordinate index and thesaurus operate in the computing system. He will then be permitted to use his own primary and coordinate index terms and thesaurus to process the summary data collected during REVIEW of his career development. This procedure actually creates the smaller esoteric information systems which Walz and Rich predict will spring up within the conception of ERIC. However, within the ISVD these smaller esoteric information systems will be really personal and not accessible to another except upon authorization of an inquirer. In fact, the smaller esoteric information systems actually are the rudiments of the cognitive structure upon which the inquirer premises his personality in the realms of educational, military, vocational, and family

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5. Tiedeman, David V.; and O'Hara, Robert P. Career Development: Choice and Adjustment. New York: College Entrance Examination Board, 1963.

decisions. ISVD will thus encourage the existence and applaud the formation of smaller esoteric information systems. These personal guidance systems constitute the compromises with totality which the individual must make in order to function within the expectations that he will be accurate, detailed, and honest with himself in an ever-maintained effort to perfect his understanding of his actions and his experience.

ISVD and Meaning through Thought, Counseling, and Supervision. Although the substitution of a personal "MONITOR" for the original System MONITOR represents a giant step toward understanding in individuality, it does not represent the completion of the process. Completion of the process further requires the machine-free use of "MONITOR" in the practiced ease of skilled appreciation of thought in experience and action. This condition is never fully attained; it is only ever more closely approximated.

The approximation to effortless ease in skilled appreciation of thought in experience and action, requires generalization of two phases of "MONITOR". One of the phases of "MONITOR" which must be generalized is that of the language of "MONITOR" itself. MONITOR will necessarily be linguistic. As Dudley and I indicate,[6] language can never be fully co-extensive with experience. Therefore, the inquirer must be encouraged to see "MONITOR" as but a stage in understanding the harmonization of language and experience, not the end result itself. The end is more akin to realization of language and experience as a paradox[7], a predicament capable of being understood and appreciated but incapable of full formal construal in co-extensive fashion.

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6. Tiedeman, David V.; and Dudley, Gordon A. Thought, Choice, and Action: Processes of Exploration and Commitment in Career Development; Cambridge, Mass.: ISVD, 220 Alewife Brook Parkway, 1967. (Multilith)
7. Tiedeman, David V. "Predicament, Problem, and Psychology: The Case for Paradox in Life and Counseling Psychology," Journal of Counseling Psychology, 1967, 14, 1-8.

The second parts of "MONITOR" which must be generalized in reaching for a practiced ease with thought, choice, and action is the experiencing of the condition in social, not just machine, context. In short, the person must move his personal "MONITOR" from machine context to interpersonal context. The counselor who supervises the inquirer's discovery of his personal "MONITOR" within the interactive computer processes of the ISVD must be the first agent of generalization of "MONITOR" from machine to interpersonal context. The counselor must use his own interaction with the inquirer as laboratory for that generalization and his skill in assessment of creative processes as his professional activity in that generalization. The supervisor of a person at school, Armed Service, or work must be the second-line agent of generalization of "MONITOR" from machine to interpersonal context. The supervisor must also use his own interaction with the inquirer as laboratory for the generalization but must in turn focus his skill in assessment and cultivation of creative processes on the <u>substance</u> of the inquirer's role obligations in the particular situation under supervision. Finally, the inquirer is himself the ultimate agent for generalization of "MONITOR" from machine to interpersonal context. The inquirer must experience the weakness of the machine MONITOR within the context of his fantasy for control over circumstance and gain confidence thereby in his capacity both to know <u>and</u> not to know his anticipatory guidance system and its consequences in his life space.

<u>But Ultimately Only Another Further Approximation of Information Generation</u>. I trust it is clear that the Information System for Vocational Decisions with its expected ramifications into non-machine and personal

collaborative activity offers potential through MONITOR, "MONITOR", counseling, and supervision of turning the processing of facts/data because of data reduction, retrieval, and use into an information generating function which in turn is used, understood, and appreciated. In this sense I believe that what Walz and Rich suspect only <u>can</u> happen within ERIC <u>will</u> happen within ISVD.

Despite the strength of my assertion for the information generation potential of ISVD, let none of us suffer the delusion that information generalization will actually occur <u>universally</u>. The ISVD will <u>expect</u> information generation to happen. The ISVD will consistently <u>attempt to make</u> information generation occur. The ISVD will be <u>diagnostic</u> about failures of information generation to appear. However, the ISVD will <u>only actually accomplish</u> information generation with those inquirers who both catch on to its theory and themselves come to use that theory without defense toward the System's part in its origin. Polanyi[8] is of similar mind with regard to the general theory of tacit understanding within which the ISVD is organized. Because of the general appearance of tacit understanding throughout past generations who lacked ISVD, I am persuaded that the rate of occurrence of this phenomenon will be even greater with use of ISVD than it is without use of the ISVD. If so, Walz' and Rich's predictions and implications <u>will</u> happen, not just <u>can</u> happen. Only the frequency of occurrence of their implications will then remain in doubt.

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8. Polanyi, Michael. "Logic and Psychology," <u>American Psychologist</u>, 1968, 23, 27-43.